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Methodology for Scoring the "Level of Environmental Impact" Criterion when Evaluating Alternatives

This is a preliminary evaluation and its objective is to provide useful information for prioritizing the alternatives in the master plan. The evaluation of environmental impact develops these and other concepts in more detail and provides a way to prioritize the alternatives in terms of the environment and sustainability.

Foundation

The current environmental regulatory structure establishes criteria, principles, requirements, standards, guidelines, and obligations needed to achieve sustainable development, environmental protection, conservation of biodiversity, and ecological equilibrium. Therefore, the basis of this evaluation is taken from the regulations contained in the Urban Development Criteria, the Urban Development Plans of Tijuana and Rosarito, the State Ecological Zoning Plan, the Tijuana, Rosarito, and Ensenada Coastal Corridor Program, and the Environmental Protection Law of Baja California.

Exclusion of elements

From these legal instruments, regulations related to the water sector were selected that were designed to prevent adverse environmental impact and to promote the sustainable use of water resources. Excluded are laws that affect the other criteria for the evaluation of alternatives, such as "the percentage of the contribution of the major supply source," the "percentage of reused effluent volume," the "proportion of extracted groundwater to artificial aquifer recharge with adequate water quality," and "efficient sludge handling."

This system was used so that the environmental criteria did not receive a double weight, since each of the previously mentioned criteria, including "level of environmental impact" in some way deals with the protection of the environment.

In addition, regulations related to prevention of environmental impacts were excluded. Technically these impacts could be reduced or avoided, or at least their mitigation was foreseeable in the later stages of the plan's projects.

Also excluded were regulations that were either common to all the alternatives, or that were obligatory to any one of the alternatives, and therefore could not be used for discrimination or differential grading of the alternatives.

Grouping the elements

All the selected official regulations were placed into four groups, according to their characteristics and to which aspects of the environment they protect, entitled as follows:

- Site Selection
- Protection of Special Conservation Areas
- Protection of Certain Species
- Protection of Waterways and Flows

The official regulations in each group are as follows:

Site Selection		
Legal Instrument	**Regulation**	
Urban Development Criteria	Urban Development (UD) is not permitted on or near active faults or fractures	▪ 30 m minimum distance from the fault, according to magnitude and activity
	UD must be at a distance of at least:	▪ 100 m from an open drainage channel ▪ 50 m from high-risk storage areas ▪ 25 m from large-scale, low-risk storage areas
	Use of large-scale storage with high contamination risk should be in areas which:	▪ Have an outside border strip of at least 25 m or more in accordance with the ecological analysis and standards ▪ Urban use is prohibited inside the strip ▪ Are placed downwind from towns
	Areas that emit high levels of atmospheric contamination:	▪ Should be placed downwind from towns
	Products that are highly flammable, explosive, or toxic:	▪ Should be placed in special areas with protective border strips in accordance with ecological analysis and standards
	Treatment Plants should:	▪ Be placed at least 500 m away from bodies of water ▪ Be placed in the lowest part of town ▪ Not allow recreational use within or around the plant ▪ Be at least 100 m away from trash dumps
	Plants that store between 100 and 30,000 barrels:	▪ Minimum safeguard distance for UD between 75 and 400 m

Site Selection		
Legal Instrument	**Regulation**	
State Ecological Zoning Plan	**Use with Incentives**: applied in areas needing effective incentives to achieve sustainable development of productive activities, in accordance with applicable ecological standards and criteria.	Applies to projects or activities in subsystems: ▪ 1.2.Pb.3.6.a-1 ▪ 1.2.Pb.3.4.a
	Use with Consolidation: Applied in areas where the level of urban development and of primary, secondary, and tertiary production activities require a policy to prevent negative environmental effects resulting from these activities, in accordance with applicable environmental standards and criteria	Applies to projects or activities in the subsystem: ▪ AC ▪ 1.2.Ti.3.9.a-6 ▪ 1.2.Ti.3.10.a-1 ▪ 1.2.Ti.3.10.a-2 ▪ 1.2.Ti.3.1.a-1 ▪ 1.2.T.3.2.a ▪ 1.2.T.3.1.a
	Use with consolidation/incentives	Applies to projects or activities in the subsystem: ▪ 1.2.Pb.3.10.a
	Use with Regulation: Applied in areas requiring optimization and control of present growth of primary, secondary, and tertiary production activities. It is meant to reduce current and potential secondary impacts resulting from these activities and to maintain reserves of natural resources, in strict accordance with ecological standards and criteria. Prevention of secondary effects of these activities is a priority.	Applies to projects or activities in the subsystems: ▪ 1.2.Ti.3.2.a ▪ 1.2.Ti.3.10.a-3 ▪ 1.2.Ti.3.9.a-1 ▪ 1.2.Ti.3.1.a-3
	Use with Consolidation/ Regulation	Applies to projects or activities in subsystem: ▪ 1.2.T.3.10.a

Protection of Special Conservation Areas		
Legal Instrument	**Regulation**	
Urban Development Criteria	Urban development is not permitted in any ecological conservation area	Ecological
State Ecological Zoning Plan	Areas of application: Marshes and estuaries Wetlands Dunes Aquifer recharge areas Protected species habitats Constructed Monuments Archeological or paleontological sites Natural monuments Areas of natural beauty Ecological transition areas Areas for shelter and reproduction Riparian ecosystems	▪ Wastewater discharge is prohibited in these areas ▪ In areas of natural beauty, the infrastructure should be designed as an integral part of the countryside ▪ Construction is prohibited ▪ Changing geological formations is prohibited ▪ Trash disposal is prohibited ▪ Special plans for protection of coastal chaparral and cactus ▪ A distance of 200 m is proposed as a barrier for these areas where the policy of Protection with Active Use will be applied ▪ Studies will be done to determine nucleus areas and a management plan for them.

Protection of Certain Species		
Legal Instrument	**Regulation**	
State Ecological Zoning Plan	Activities taking place in the state should not interrupt the flow and communication of biological corridors	
Official Mexican Regulation NOM-059-ECOL-2001	In general	Protect species that are probably extinct, threatened, endangered, and subject to special protection
	Cactus:	Protect all cactus specimens in the region
		Along the coast of Tijuana-Rosarito: Care for all hillsides facing south due to the presence of *ferocactus viridescens*
	Conifers:	Protect all natural specimens of conifers, pines, and cypresses

Protection of Waterways and their Flows	
Legal Instrument	**Regulation**
State Ecological Zoning Plan	Draining bodies of water and obstruction of water flow is prohibited

Weighting the elements:

Because of the importance of many factors that make up each element, in order to score the different alternatives weights were assigned as follows:

- Site Selection 30 percent
- Protection of Special Conservation Areas 25 percent

- Protection of Certain Species 25 percent
- Protection of Waterways and their Flows 20 percent

Reasons for the weights:
For Site Selection, the weight takes into account protection of life, health, and goods, reduction of risks, and reduction of social costs (less public resistance).

For Protection of Special Conservation Areas and Protection of Certain Species, the weights are derived from protection of the ecosystems, maintaining biodiversity and ecological balance, and the preservation of cultural and natural heritage.

For the Protection of Waterways and their Flows, the weight is derived from conservation and sustainable use of natural elements.

Scale for scoring alternatives:

Factor 1: Site Selection (30 percent)
To score this factor, the patterns of use of the previously mentioned regulations were considered, dividing the patterns into two groups: those related to Urban Development and that foster life, health and human development; and those related to the ecological zoning (i.e., to environmental protection, pollution prevention and ecological balance).

On the following scale, each group of patterns is weighted equally:

Urban Development Criteria	
Item	**Score**
Complies with the urban development criteria	5
High probability of compliance	4
Certain conditions required for compliance	3
Presents difficulties for compliance	2
Does not comply or probably does not comply	1

Ecological Zoning	
Policy of Use	**Score**
Use with Incentives	5
Use with Incentives / Consolidation	4
Use with Consolidation	3
Use with Incentives /Regulation	3
Use with Consolidation / Regulation	3
Use with Regulation	2
Protection with Active Use	1

Factor 2: Protection of special conservation areas (25 percent)
The grading scale was based on the same criteria established by the environmental regulations, according to the degree of vulnerability of the different Special Conservations Areas. These areas, listed in order of vulnerability from greater to

lesser, are: Fragile Ecosystems, Areas of Ecological Importance, and Cultural and Natural Heritage.

The following scale was used:

Location Criterion	Score
More than 5 km from fragile ecosystems Coastal Lagoons Marshes Estuaries Wetlands Dunes	5
Between 2 and 5 km from areas of ecological importance Aquifer recharge zones Transitional zones Areas for shelter and reproduction of different species Representative areas (desert and Mediterranean) Riparian ecosystems	5
More than 500 m from areas of natural or cultural heritage	5
Between 2 and 5 km from fragile ecosystems	4
Between 1 and 2 km from areas of ecological importance	4
Between 200 and 500 m from areas of natural or cultural heritage	3
Between 1 and 2 km from fragile ecosystems	3
Between 200 m and 1 km from areas of ecological importance	3
At least 200 m from areas of natural or cultural heritage	3
Between 200 m and 1 km from fragile ecosystems	2
At least 200 m from areas of ecological importance	2
At least 200 m from fragile ecosystems	1

Factor 3: Protection of certain species (25 percent):
(This score is pending. An inspection of the areas where infrastructure needs to be placed was required to complete the necessary information. As soon as this information is collected, it will be incorporated.)

Factor 4: Protection of waterways and their flows (20 percent):
Based on the previously mentioned regulations, the following criteria and grading scale were established:

Criterion	Score
Building or construction work more than 500 m from the banks or waterways (Greater than 2 km for WWTPs)	5
Building or construction work between 100 and 500 m from the banks or waterways (Between 1.5 and 2 km for WWTPs)	4
Building or construction work between 50 and 100 m from the banks or waterways (Between 1 and 1.5 km for WWTPs)	3
Building or construction work at least 50 m from the banks or waterways (Between 700 m and 1 km for WWTPs)	2
Building or construction work on the banks or waterways (Between 500 and 700 m for WWTPs)	1

Methodology for Scoring the "Efficient Sludge Handling" Criterion when Evaluating Alternatives

Similar to the weighting of the elements of the criterion for discerning alternatives related to the "Level of Environmental Impact", the following legal instruments and official regulations were taken into account for "Efficient Sludge Handling".

Legal Instruments	Regulation	
General Law of Ecological Balance and Environmental Protection Environmental Protection Law of Baja California	Sustainable use of the land and its resources	▪ Land use should be compatible with its natural function ▪ Ecological balance should not be altered ▪ Use of lands should maintain its physical integrity and productive capacity ▪ Should consider the necessary means to prevent or reduce the deterioration of the physical, chemical or biological properties of the land and the loss of natural vegetation
	Prevention and control of soil contamination	▪ Wastes should be controlled, since they constitute the principal source of soil contamination ▪ It is necessary to reduce the generation of wastes and to incorporate techniques for waste reuse and recycling
State Ecological Zoning	▪ Integral plans for waste handling will be implemented ▪ Waste reuse and recycling will be promoted ▪ The construction of waste disposal infrastructure should not take place near the aquifer layer or permeable soils ▪ Using organic waste that does not contain toxic substances or contaminants as organic fertilizer is recommended ▪ Waste disposal is prohibited in special conservation areas ▪ Alteration of areas essential for aquifer recharge is not allowed	

The useful factors for the weighting of criteria, which seem to be subject to knowing the differences in how they are treated in each one of the alternatives, are:

- The quantity and quality of sludge generated for each alternative;
- The percentage of sludge that is reused or recycled;
- The diversity of uses in its implementation; and
- The selection of final disposal site.

The last three of these factors are related to the quality of sludge generated, while the first one deals with the quantity generated. Therefore, the factors are summarized

according to the quantity and quality of sludge generated, giving equal weight to each one.

Scale for the grading of alternatives:

Factor 1: Quantity of Sludge Generated (50 percent)	
Criterion	**Score**
Very low quantity that requires removal one or less times per year	5
Requires removal at least once every six months	4
Requires removal at least once every two months	3
Requires removal at least once per month	2
Requires removal several times per month	1

Factor 2: Quantity of Sludge Generated (50 percent)	
Criterion	**Score**
Excellent stabilization and the content of contaminants allows for its unrestricted use	5
Excellent stabilization and the content of contaminants is acceptable for restricted use	4
Good stabilization and the content of contaminants allows for its confinement in sanitary landfills	3
Moderate stabilization and the content of contaminants requires specialized confinement, but it is not considered dangerous	2
Exhibits dangerous characteristics	1

Recommendations for the Implementation of the "Proportion of Extracted Groundwater to Artificial Aquifer Recharge with Adequate Water Quality" Criterion While Evaluating Alternatives

Although the implementation of this criterion seems simple and straightforward, considerations relevant to the environmental context should be included, such as the following:

Legal Instrument	Regulation	
Urban Development Plan of Tijuana	Promote the protection of bodies of water, avoiding the contamination of the aquifers	
Urban Development Plan of Rosarito	Ecological Preservation Policy in: the Zona Centro, Machado, Huahuatay, Lomas Altas and Playas de Rosarito	▪ Maintain the ecological balance through the conservation of coastal and aquifer recharge areas and areas not recommended for urban activity.
State Ecological Zoning Plan	General Guidelines	▪ Alteration of areas essential for the processes of aquifer recharge is not allowed ▪ Rescue and protection plans will be established for runoff areas for aquifer recharge ▪ The established prohibitions on the exploitation of the aquifer level will be followed

From the previous graph it can be inferred that when implementing this criterion, high scores should be given to the alternatives that:

- Obtain the highest quality of wastewater;
- Maintain a proportion of (recharge/extraction) of 1.0 or greater; and
- Incorporate a program or plan for protection of recharge areas that contain complete studies of the aquifer

Recommendations for the implementation of the criteria: Although the methodology to score the rest of the criteria was not developed, it is important to state these recommendations for their implementation, since the environmental context raises considerations relevant to each case and to existing urban and environmental planning

Recommendations for the Implementation of the "Percentage of Reused Effluent Volume" Criterion, While Evaluating Alternatives

Similar to the previous criterion, the implementation of this criterion should consider the following:

Legal Instrument	Regulation	
State Ecological Zoning Plan	General Guidelines: Water Resource	▪ Potable water conservation and gray water reuse will be encouraged ▪ The reuse of treated wastewater for irrigation of green areas will be promoted
	Policy of Use with Consolidation	▪ Recycling and reuse of domestic wastewater and from productive activities will be promoted
Environmental Protection Law of Baja California	Criteria	▪ The reuse and use of treated wastewater is an efficient way of using and preserving the resource
	Obligations	▪ The proper authorities will promote the efficient conservation and use of water, and the treatment and reuse of wastewater
Zoning of Tijuana, Rosarito, and Ensenada Coastal Corridor	Policy of Urban Incentives for the UGA* of Playas de Tijuana	▪ Encourage the installation of treatment plants and promote the use of treated wastewater for the irrigation of parks and gardens
	Policy of Low Density Tourist Consolidation for the UGA* of Punta Bandera	▪ Promote the use of treated waters for irrigation

Legal Instrument	Regulation	
	Policy of Tourist Incentives for the UGA* of Real del Mar	▪ Regulate the use of treated water for irrigation
	Policy of Low Density Tourist Consolidation for the UGA* of El Descanso	▪ Given that tourism and businesses constitute the highest demand, encouraging the use of wastewater treatment plants is recommended to recycle water or to empty it into the sea after treatment
*UGA refers to a district whose lines are drawn around the watersheds found in and around that municipality.		

In the implementation of this criterion, high scores should be given to the alternatives that:

- Obtain the highest proportion of (reused volume/effluent volume);
- Have the greatest diversity of applications and uses of treated wastewater; and
- Obtain the best quality wastewater

Recommendations for the Implementation of the "Level of Implementation and Execution Risk" Criterion, While Evaluating Alternatives

The official regulations that deal with the environment and urban development may influence the implementation risks of alternatives, as described below:

Legal Instrument	Regulation	
Urban Development Plan of Rosarito	Policy of Ecological Preservation for the areas: Centro, Machado, Huahuatay, Lomas Altas and Playas de Rosarito	▪ Make the developments conditional on their adequate integration into the natural environment and their need to supply their own services without depending on the urban networks. However, the waterways, agricultural areas and those areas subject to risk should be respected
Zoning for the Tijuana, Rosarito and Ensenada Coastal Corridor	Policy of Tourist Incentives for the UGA of: Real del Mar	▪ Incompatibility with urban and suburban uses ▪ Incompatibility with primary activities
	Policy of Protection for the UGA of: El Morro Valley	▪ Incompatibility with urban development ▪ Incompatibility with high, medium and low density tourist activities ▪ Incompatibility with primary activities ▪ Incompatibility with the development of infrastructure

Legal Instrument	Regulation	
	Policy of Protection for the UGA of: El Descanso Estuary	▪ Incompatibility with urban and suburban uses ▪ Incompatibility with high, medium and low density tourist activities ▪ Incompatibility with primary activities ▪ Incompatibility with the development of infrastructure
	Policy of Protection for the UGA of: La Misión Laderas	▪ Limit construction on both banks (to 100 m) ▪ Incompatibility with urban and suburban uses ▪ Incompatibility with tourist uses (tourist developments, housing and hotels) ▪ Incompatibility with primary activities ▪ Incompatibility with regional infrastructure
	Policy of Protection of the UGA: La Misión Mesetas	▪ No expansion of construction
*UGA refers to a district whose lines are drawn around the watersheds found in and around that municipality.		

Therefore, we should conclude that the introduction of potable water services and sanitation of wastewater promotes, in addition to urban development, the creation of infrastructure and development of other activities, such as tourism and industrial activity. Therefore, the introduction of services in areas restricted by the official regulations could face execution risks in the short and middle term.

When applying this criterion, in addition to the already established risks, one should consider the risks associated with:

- Conflict with the Urban Development and Ecological Zoning Plans,
- Social acceptance or rejection,
- Uncertain land ownership,
- Political situations,
- Foreign exchange risks
- Availability of technology.